Fiscal Monetary Services and Inflation

Response to Referee Comments

October 13, 2022

I would first like to thank the editor, associate editor, and reviewers for this opportunity. The feedback I've received has been excellent and the suggestions have elevated this paper in more ways than one. Below, I address the comments and suggestions as best I can and in as straight-forward a manner as I can, starting with the main point that both reviewers addressed. Throughout, I'll refer to the reviewer who's report begins with "High levels of..." as *Referee 1* and to the reviewer who's report begins with "This paper quantifies..." as *Referee 2*.

1 Tighter Link Between the Motivation and the Empirics

In this paper I consider a simple partial equilibrium model to motivate the creation of my Fisher Ideal Index of US Treasury debt. The referees and the editor were correct to point out that I did not complete the full theoretical motivation before moving to the empirical exercises. To bridge this gap, I include a new section titled "Monetary–Fiscal Interaction with Fiscal Monetary Services" (Section 6) where I outline the rest of the model and explore the implications of having both short- and long-term debt in the utility function. To keep the model and the mechanism as simple as possible, I fill out the firm and monetary/fiscal sides in line with Belongia and Ireland (2014) and others.

1.1 Adjustments to the Initial Model

In order to separate the impact of increased Treasury-oriented monetary services from a preference shock to monetary services, more generally, I add fiat currency F_t to the this iteration of the model, which shows up both in the budget constraint and in the monetary services aggregate

$$M_t = \left[\lambda_1^{\frac{1}{\sigma}} F_t^{\frac{\sigma-1}{\sigma}} + \epsilon_t^s \left(\lambda_2^{\frac{1}{\sigma}} B_t^{\frac{\sigma-1}{\sigma}} + \lambda_3^{\frac{1}{\sigma}} B_t^{L\,\frac{\sigma-1}{\sigma}}\right)\right]^{\frac{\sigma}{\sigma-1}}, \tag{8*}$$

where $\lambda_1, \lambda_2, \lambda_3 \geq 0$ and $\sum_{i=1}^{3} \lambda_i = 1$. The term ϵ_t^s can then be interpreted as a monetary services shock to the debt portfolio, but with the understanding that these are not the only assets that provides monetary services. The shock follows an AR(1) process in its logarithm

$$\ln \epsilon_t^s = (1 - \rho_s) \ln \epsilon^s + \rho_s \ln \epsilon_{t-1}^s + \varepsilon_t^s, \tag{24}$$

where $\rho_s \in [0,1]$, $\epsilon^s = 1$, and $\varepsilon_t^s \sim \mathcal{N}(0, \sigma_s^2)$.

Additionally, to keep the notation and modeling consistent across Sections 3 and 6, I change the income tax to a lump-sum tax in both the initial and and expanded models. This keeps it in line with the standard Leeper (1991) analysis and does not impact the index-number motivation in Section 3.

1.2 The Determinacy Properties

I close the model with monetary and fiscal policy rules. On the monetary side, I consider a simple (log-linearized) Taylor rule with a rate-smoothing option included

$$\tilde{r}_t = \rho_r \tilde{r}_{t-1} + (1-\rho_r)\left[\rho_\pi \tilde{\pi}_t + \rho_y \tilde{y}_t\right] + \varepsilon_t^r, \tag{27}$$

where $\rho_r \in [0,1]$, $\rho_\pi, \rho_y \geq 0$, and $\varepsilon_t^r \sim \mathcal{N}(0, \sigma_r^2)$. For most of the analysis, however, I assume $\rho_r = \rho_y = 0$. On the fiscal side, the lump sum tax reacts to the change in total new borrowing, with a smoothing option included here as well

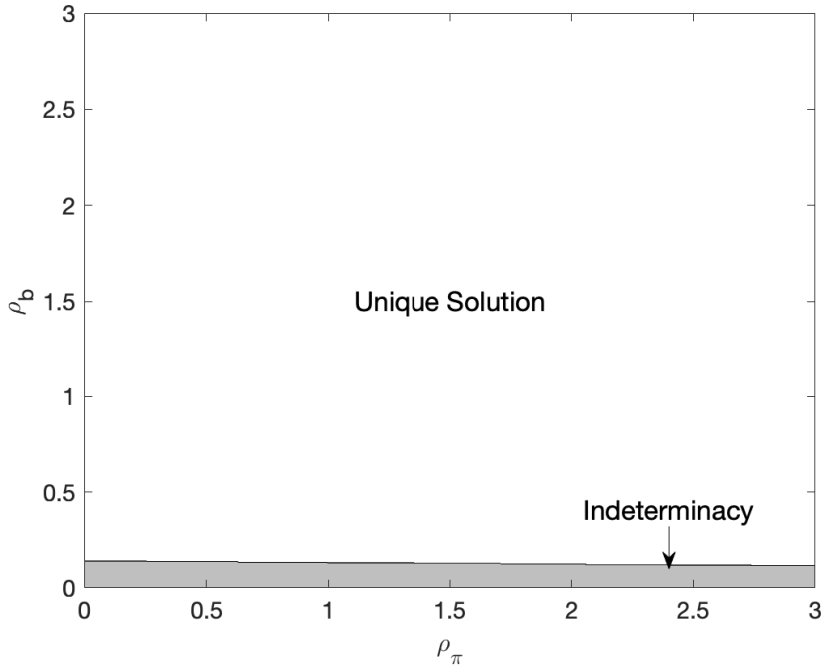
$$\tilde{\tau}_t = \rho_\tau \tilde{\tau}_{t-1} + (1-\rho_\tau)\rho_b \left[\frac{b}{b^{L,n}+b}\tilde{b}_t + \frac{b^{L,n}}{b^{L,n}+b}\tilde{b}_t^{L,n}\right], \tag{26}$$

where $\rho_\tau \in [0,1]$ and $\rho_b \geq 0$. Again, I generally assume $\rho_\tau = 0$ for simplicity of the analysis. It should be noted that, as is standard with policy functions of this design, the amount of smoothing has little effect on the determinacy of the parameter space, if any.

The inclusion of short- and long-term debt in the utility function under this type of fiscal rule alters the standard determinacy regions, as shown in Figure 10 (included in this writeup below). Under the assumptions of this model, determinacy is almost exclusively determined by fiscal policy, but there is no separation in "active" versus "passive" in the standard sense. I then consider how the liquidity premiums in the short- and long-term rates (equations 28 and 29) include a stock effect that increases rates with the issuance of new debt. Thus, so long as the tax rate reacts to the issuance of new debt forcefully enough, this stock effect provides stability without needed reenforcement from monetary policy explicitly.

Additional Results In the manuscript, I limit the determinacy region analysis to the functional form given by (26). I explored expansion of the parameter space up to

Figure 10: Determinacy Properties of the Policy Parameter Space



$\rho_b = \rho_\pi = 10$, with no changes from Figure 10. Alterations to this rule, however, do change these properties, but not always in a way that is significant or useful in the current context. For instance, if the fiscal authority reacts to lagged new debt issuance (b_{t-1} and $b_{t-1}^{L,n}$), the model exhibits explosive dynamics at a point above $\rho_b \approx 2.4$. I do not include this result since anything above that is outside the standard calibration of these types of models. Additionally, if the lump-sum tax were to react to the total debt stock (b_t and b_t^L, both current and lagged), the entire standard parameter space yields infinite solutions. While I would like to explore this more in future work, I feel like it's not very useful for the purpose of the model in this particular manuscript. If the editor and/or the referees deem them important enough to include, I can do so in future iterations.

1.3 Is it Really FTPL?

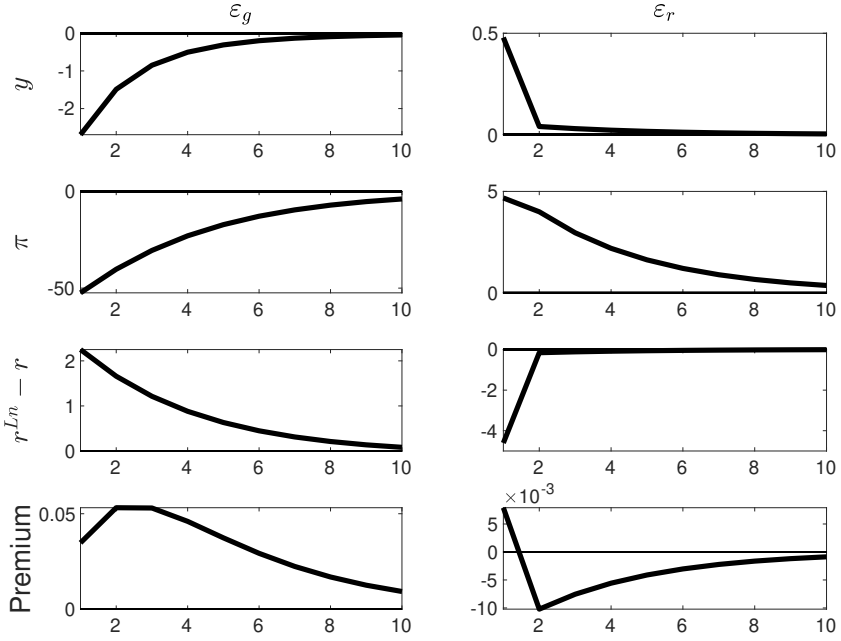
Referee 1 pointed out that

> However, when government debt also provides safety and liquidity services

and fiscal policy does not respond at all to changes in government liabilities, an expansion in government debt can even be *deflationary*, which is reminiscent of Japan's experience that critics of the FTPL often point to.

This turned out to be the case in my model as well, as Figure 11 shows. Here, I find the standard FTPL result from the monetary side of policy, but Referee 1 was correct to suggest that fiscal policy overall might be deflationary. However, instead of holding only for when fiscal policy "does not respond at all," this result holds for all parameterizations that yield a unique solution. Because of this, I have reworked the narrative of the paper to highlight that a) yes, the monetary services provided by fiscal debt is inflationary (explored in Section 1.4 below), but b) this result does not require that the standard FTPL channels hold. It is, instead, working through the term premiums.

Figure 11: Impulse Response Functions for Policy Shocks



1.4 Tying the Theory to the Empirics

While the impulse response functions suggest that increased government debt can be deflationary in the model, this does not rule out the possibility that the monetary services are inflationary. Indeed, throughout my empirical exercises I attempt to control for the stock effect in order to separate those two. As added motivation that this can be the

case, I now begin my discussion of the impact of these monetary services on inflation with the results of the theoretical model (Section 7.1). The impulse response to a shock to these monetary services shows that they are inflationary in the model, even if the stock of debt itself is deflationary. I believe that this adds a solid theoretical foundation to my empirical results. There may be other channels supporting this one, but I cannot explore those thoroughly enough under the current framework.

2 Other Comments

While the primary focus of both referees seems to be the theoretical link between the measurement's motivation and the empirical results, there are some additional comments that I attempt to address below.

2.1 Liquidity versus Bubbles

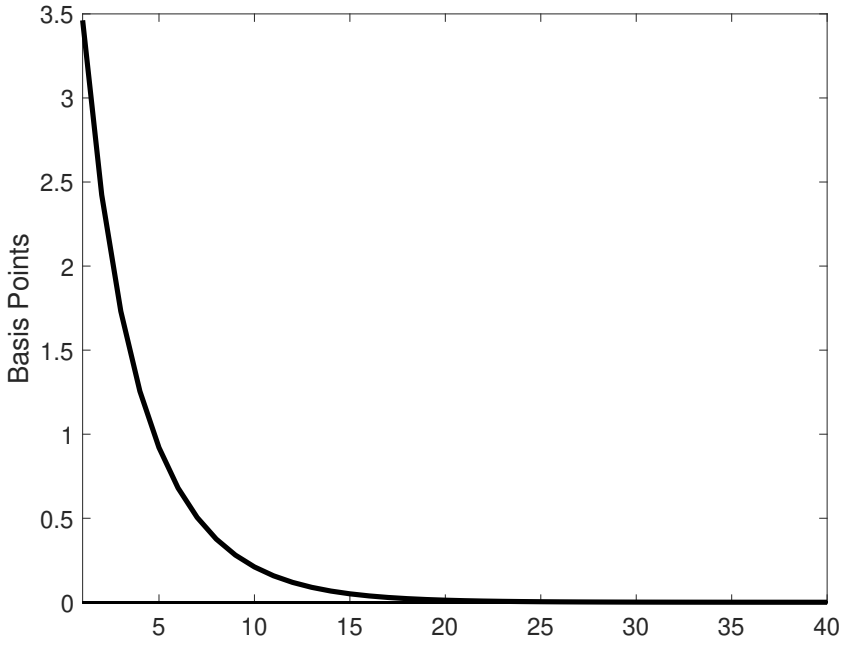
Both referees make a good point that, while I spend much of my literature review citing Brunnermeier *et al.* (2020), I don't directly address bubbles in this paper. A small-scale model seemed the best way to address the largest concern above, which tends to abstract from the $r < g$ situation. In attempting to analyze this, however, I've found that the introduction of a long-term bond into the utility function and a separate long-term benchmark asset creates some odd dynamics.

For instance, under a calibration where the short term rate is less than zero ($r < 0$), but the long-term rate and the benchmark rate are above zero ($0 < r^{L,n} < R^n$), there is no standard parameter combination that leads to a unique solution. Only when all three rates are less than zero, and the discount factor is forced into $\beta < 1$, is there a unique solution. In such a setting, a shock to the monetary services still has a positive impact on inflation, though to a lesser degree, as Figure A shows.[1] So while a bubble term may have an impact on this result beyond the liquidity services, I believe the dynamics of a model under such assumptions (long- and short-term debt in the utility function) need to be more thoroughly explored and would be better suited for its own paper. In the mean time, I have adjusted the rhetoric of this paper to be less reliant on the bubble

[1] This is compared to the results in Figure 12 in the manuscript.

literature, focusing on Brunnermeier *et al.* (2022) and only citing their earlier work when motivating the exercise in the Introduction (pg 2) and in Section 3.3 (pg 11).

Figure A: Inflation IRF for Monetary Services Shock: $r < 0$



2.2 Interdependence of Liquidity and Safety Premiums

Referee 2 brings up a number of important points about the interdependence of the premiums. The first being:

> But these two premia are not independent of each other. Is safety premium a function of liquidity premium, or the other way around, or they are both functions of something else?

The confusion on this is my fault, as there were a couple of omissions in the manuscript. First, in my analyses of these premiums (Section 5.2), I include lagged values of the mentioned liquidity and safety spreads in an attempt to control for just this situation. I have adjusted the language to reflect this on page 19. If either of the referees or the editor prefer I consider a different approach, please let me know. Second, I do not make it clear that index number theory and its standard motivation do not separate the various monetary services provided by the underlying assets, but rather let the data

speak for itself. Because of this, my theoretical model explores the channel generally, then I attempt to separate them empirically. I have included statements to make that more clear in the first paragraph of Section 5.2. In fact, this is a rather large hole in the overall monetary aggregation literature. Attempting to develop a measurement that separates the various contributions and would likely require a larger model with more explicit liquidity and safety channels, but would provide valuable knowledge about the underlying assets and from where they're deriving their value. I have added a short discussion of this to the concluding section as an avenue for future research.

The second point regarding the interdependence of liquidity and safety is

> Additionally, I would have thought these premia have good connections with inflation, so Section 6 on inflation should be part of Section 5.2 and Section 5.3 on the premia and fiscal capacity.

Initially, I agreed with this idea. However, the inclusion of the full theoretical model discussed above seemed to fit best after the measurement portion of the manuscript (Sections 4 and 5), but then became additional motivation for the impact of these monetary services on inflation. So for now I still have the inflation portion in its own section, but am willing to rearrange the material if Referee 2 still deems it necessary.

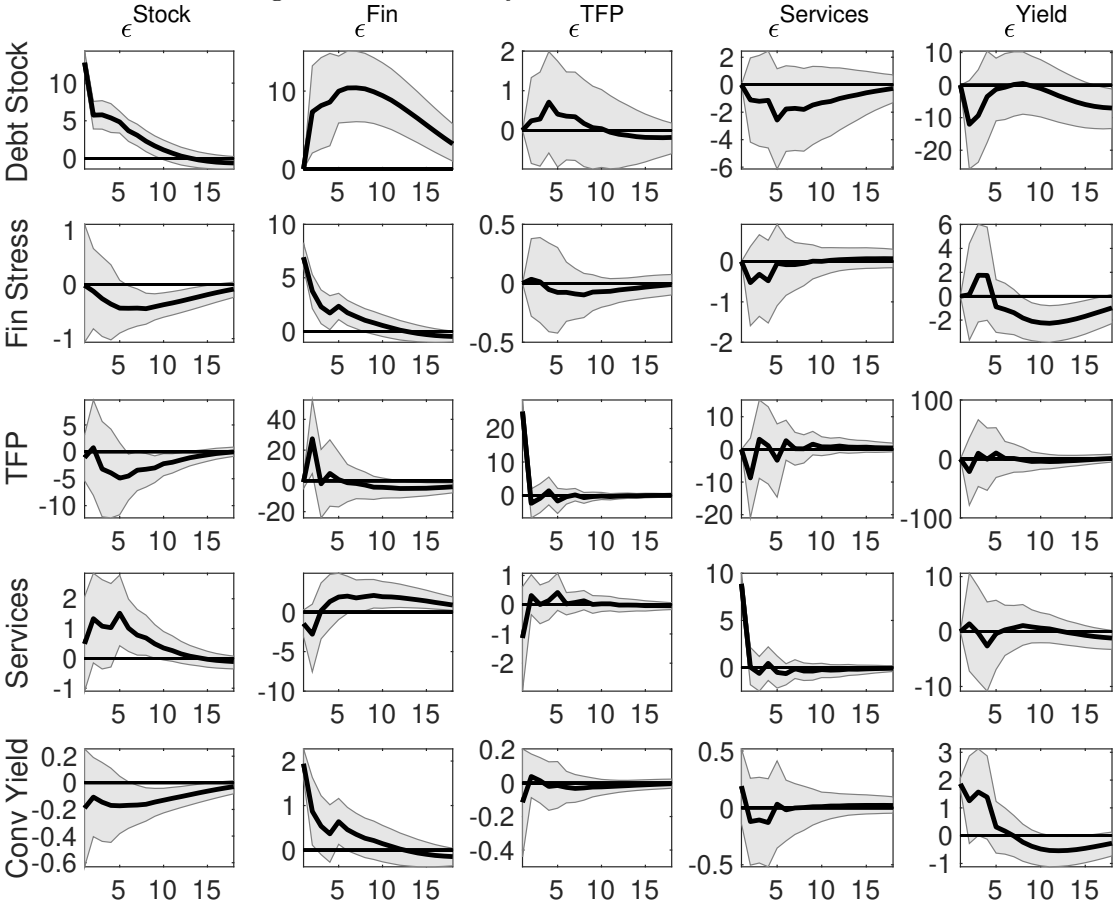
The final point considers the rationality for holding liquidity

> The idea is that holding liquidity is for hedging future investment risks; depending on the nature of the shock, the hedging motive could vary. Different shocks (e.g., financial shocks v.s. aggregate productivity shocks, see Cui and Radde, 2020) may generate different cyclicalities of the spread. Those shocks may correlate with the shocks to fiscal monetary services. I would suggest doing some VAR analysis of these three and other macro variables that capture production and the financial sector.

This is an excellent point and one that I'm happy to explore, though I don't find much substance in my results. I consider a VAR model with the following five variables: the quarter-over-quarter growth rate of the stock of outstanding Treasury principal (to control for stock effects), the Kansas City Financial Stress Index, the quarterly growth of utilization-adjusted Total Factor Productivity as measured by Fernald (2012), the quarter-over-quarter growth rate of fiscal monetary services measured in this manuscript,

and the convenience yield as measured by the AAA–10yr Treasury spread.[2] All variables are quarterly in frequency and four lags are considered via AIC. Identification is obtained with a Cholesky decomposition and the 90-percent confidence intervals are evaluated via bootstrapping.[3] The results can be found in Figure B.

Figure B: VAR Analysis of the Convenience Yield



As can be seen in the figure, there are differences in the response of the convenience yield to financial and productivity shocks. An increase in financial stress creates a large increase in the convenience yield as expected. As is suggested in the manuscript, the growth in these financial services is driven by a stock effect, and a negative financial market shock does cause the growth rate of these monetary services to increase, though

[2] Other Federal Reserve Banks have financial stress indices, but all are highly correlated and the Kansas City variation has the largest sample size.

[3] Each sub-figure presents the 5th, 50th, and 95th percentile response to the shocks. Qualitative results are robust to changes in the ordering of the variables.

this is more of a long-term effect. The short-term lack of statistical significance could be due to the mixed services each type/maturity of Treasury security provides, as outlined in Section 5.2 of the manuscript. If it is assumed that liquidity is of primary importance in the wake of a negative financial shock, then the lack of liquidity at the back end of the yield curve would match this initial response. Additionally, an increase in the growth of monetary services has no statistically-significant impact on the convenience yield, a result that matches that seen in Figure 7. Generally speaking, I do not believe that the results of this exercise change the narrative of the manuscript. So for now, I leave these results in this response, but have not added them to the manuscript. Again, if the editor or referees see something I'm missing in these results, I'd be more than willing to add them into the manuscript where they see fit.

3 Smaller Points

The first of Referee 1's additional, minor points is addressed in Section 2.1 above. I address the other two and the editor's comment below.

3.1 Self-Evaluation

Referee 1 suggested that I

> ... avoid self-evaluating the contribution of the paper (e.g., ?significant contribution? on p. 1 and p. 2). The readers will do.

I have removed these specific instances from my manuscript and have adjusted my language to avoid this in other instances as well.

3.2 Word Play

Referee 1 also suggested an alteration to my use of the classic Milton Friedman quote:

> Even with the empirical relevance of fiscal monetary services, I believe it is more prudent to say that "inflation is always and everywhere a joint monetary-fiscal phenomenon" (p. 3).

I do believe that this is a better characterization of my results and have made the alteration.

3.3 Clarification of Variables

The editor made a good point that I should have been more careful in explaining which of my variables were real and which were nominal. I have added language to Sections 5.2 and 7.2 to better clarify the variables I consider.

4 Odds and Ends

One last thing I should note is that I have also changed the motivating narratives in the first paragraphs of the Introduction and Conclusion sections. Both initially claimed that while government debt had continued to increase, interest rates remained low and inflation had only begun to rise. Even with the relatively quick turnaround on this submission, this is no longer true, and the wording as been changed to reflect that.

References

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